

CLAIMS:

1. A method for making a prototype plastic injection molded part, comprising the steps of:
 - 10 providing computer file data representing a mold tool;
 - building the mold tool by depositing roads of a molten thermoplastic resin in layers in a predetermined pattern defined by the computer file data, the mold tool defining a mold cavity; and
 - 15 using the mold tool in an injection molding machine, without the additional of any reinforcement fill material or layers, to create the prototype part by injection molding of plastic.
2. The method of claim 1, wherein the thermoplastic resin comprises at least about 50 weight percent of a thermoplastic selected from the group consisting of polyphenylsulfone, polysulfone, polystyrene, polyphenylene ether, amorphous polyamides, polycarbonate, acrylics, nylon, poly(2-ethyl-2-oxazoline), and blends thereof.
3. The method of claim 1, wherein the thermoplastic resin is a polyphenylsulfone-based resin.
4. The method of claim 1, wherein a sprue channel and alignment holes are formed into the mold tool as it is built.
- 25 5. The method of claim 1, and further comprising the step of: machining a sprue channel into the mold tool, prior to the step of using the mold tool in an injection molding machine.
6. The method of claim 1, and further comprising the step of:
 - 30 machining a plurality of alignment holes into the mold tool, prior to the step of using the mold tool in an injection molding machine.
7. The method of claim 1, wherein the predetermined pattern results in the mold tool having a porosity sufficient to vent gas in the mold cavity generated by injection of the plastic.
- 35 8. The method of claim 1, wherein a vent channel is formed into the mold tool as it is built.
9. The method of claim 1, and further comprising the step of:

machining a vent channel into the mold tool, prior to the step of using the mold tool in an injection molding machine.

10. The method of claim 1, and further comprising the step of: coating surfaces of the mold cavity with a release agent prior to the 5 step of using the mold tool in an injection molding machine.
11. The method of claim 1, wherein the step of building the mold tool comprises building two or more mating mold portions, each mold portion having a mold surface, a mating surface, and a base which supports the mold and mating surfaces, the mold surfaces together defining the mold 10 cavity.
12. The method of claim 11, and further comprising the step of: smoothing surfaces of the mold tool prior to the step of using the mold tool in an injection molding machine.
13. The method of claim 11, wherein the step of building the mold tool 15 further comprises building a mold core.
14. The method of claim 13, and further comprising the step of: assembling the mold core in the mating portions of the mold tool prior to the step of using the mold tool in an injection molding machine.
- 20 15. The method of claim 14, wherein the thermoplastic resin forming the mold core is an alkali-soluble thermoplastic, comprising a base polymer containing between about 15 weight percent and 60 weight percent of a carboxylic acid, and a plasticizer, and further comprising the step of: dissolving the mold core from the prototype part.
- 25 16. A method for making a prototype plastic injection molded part, comprising the steps of:
 - providing computer file data representing a mold tool;
 - building the mold tool by depositing roads of a molten soluble thermoplastic resin in layers in a predetermined pattern defined by the computer file data;

using the mold tool in an injection molding machine, without the additional of any reinforcement fill material or layers, to create the prototype part by injection molding of plastic; and dissolving the mold tool to release the prototype part.

- 5 17. The method of claim 16, wherein the soluble thermoplastic resin is an alkali-soluble thermoplastic comprising:
- a base polymer containing between about 15 weight percent and 60 weight percent of a carboxylic acid, and a plasticizer.
- 10 18. The method of claim 17, wherein the carboxylic acid is methacrylic acid and wherein the base polymer further contains an alkyl methacrylate.
19. The method of claim 18, wherein the alkyl methacrylate is methyl methacrylate and wherein the base polymer contains between about a 1:1 to a 1:2 weight percent ratio of methacrylic acid to methyl methacrylate.